

CLAIMS

What is claimed is:

1. A process comprising the acts of:

5 hardening a metal layer of a semiconductor wafer prior to chemical mechanical planarization (CMP); and performing CMP on the semiconductor wafer.

2. The process, as set forth in claim 1, wherein hardening of the metal layer

10 comprises making the metal layer more resistant to abrasion.

3. The process, as set forth in claim 1, wherein hardening of the metal layer

comprises making the metal layer more resistant to chemical attack.

15 4. The process, as set forth in claim 1, wherein hardening of the metal layer

comprises oxidizing the metal layer.

5. The process, as set forth in claim 4, wherein a thickness of an oxide layer

formed on a surface of the metal layer is in the range of 300-600 angstroms.

20

6. The process, as set forth in claim 4, wherein the metal layer comprises

copper.

7. The process, as set forth in claim 4, wherein copper oxide is formed on the metal layer.

8. The process, as set forth in claim 4, wherein the metal layer comprises
5 tungsten.

9. The process, as set forth in claim 8, wherein tungsten oxide is formed on the metal layer.

10 10. The process, as set forth in claim 1, wherein hardening of the metal layer comprises coating a surface of the metal layer with polymer.

11. A process comprising the acts of:
oxidizing a metal layer of a semiconductor wafer prior to chemical mechanical
15 planarization (CMP) of the metal layer; and
performing CMP on the metal layer.

12. The process, as set forth in claim 11, wherein the semiconductor wafer has one or more metal contact plugs.

20 13. The process, as set forth in claim 11, wherein during oxidation of the metal layer, the temperature surrounding the semiconductor wafer is elevated to a predetermined temperature for a predetermined period of time.

14. The process, as set forth in claim 13, wherein the predetermined temperature is in the range of 150-250 °C.

5 15. The process, as set forth in claim 13, wherein the predetermined period of time is in the range of 1-2 minutes.

16. The process, as set forth in claim 11, wherein the metal layer is oxidized in an annealing process.

10 17. The process, as set forth in claim 16, wherein the metal layer is oxidized with oxygen.

18. The process, as set forth in claim 16, wherein the metal layer is oxidized with ozone.

15

19. A method comprising the acts of:

plating a semiconductor wafer with a metal layer;

annealing the wafer;

introducing an oxidant near the end of an annealing cycle;

20 oxidizing a surface of the metal layer prior to chemical mechanical planarization (CMP) of the wafer; and

applying CMP to the wafer.

20. The method, as set forth in claim 19, wherein the oxidant comprises oxygen (O₂).

21. The method, as set forth in claim 19, wherein the oxidant comprises ozone 5 (O₃).

22. The method, as set forth in claim 19, wherein the metal layer comprises copper and the CMP comprises copper CMP.

10 23. The method, as set forth in claim 19, wherein the metal layer comprises tungsten and the CMP comprises tungsten CMP.